Development of Organic Semiconductor Lasers

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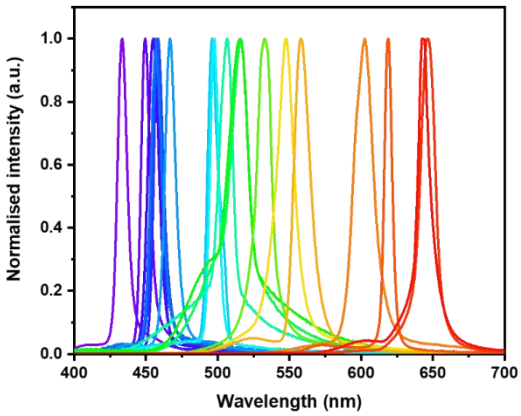
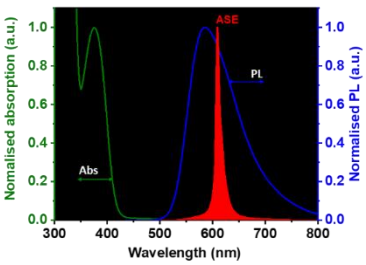
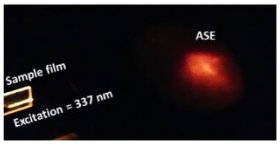
Abstract:

Lasers using organic semiconductor materials as the gain media have great potential for a wide range of applications such as optical data communications, display, sensors, security tags and spectroscopy. This is mainly because organic materials are cost-effective, lightweight, high mechanical flexibility, ultrashort pulses, and high wavelength tunability, compared with inorganic semiconductor counterparts. Excellent progress on the development of organic semiconductor lasers has been made over the last decades. This includes new materials creations with high performance upon optical excitation, new chemical structures in achieving high gains and low amplified spontaneous emission (ASE) threshold values, and room temperature polariton lasing with low thresholds, as well as a breakthrough in lasing action under current injection. However, more robust and high performing materials enabling emission colours across the whole visible spectrum are required, where achieving a low ASE threshold particularly for organic red laser chromophores has been a challenge.

In this presentation, new advancements in organic laser materials will be demonstrated with emission from blue to red. Our key material designs in attaining high laser performance will be outlined. New insights into the optical loss pathways, contributing to the ASE threshold values, will be highlighted. Moreover, our strategies to diminish optical losses and our approaches to enhancing material photostability will be discussed. Finally, electroluminescence of the new classes of organic laser chromophores using organic light-emitting diodes (OLEDs) will be demonstrated, including our approaches to high performing OLEDs.







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